Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

TRANSACTIONS
OF
American Microscopical Society
(Published in Quarterly Installments)

Vol. XXXIII JULY, 1914 No. 3

A NEW HENLEA (ENCHYTRÆIDÆ) FROM NORTHERN MICHIGAN.*

BY PAUL S. WELCH.

At present more than fifty species are assigned to the genus *Henlea*. Whether or not all are valid remains to be proven, but nevertheless it is apparent that the group is much larger than was formerly supposed and that it has a wide distribution. A number of contributions to the genus have recently appeared. Friend ('12, '13a, '13b, '13c, '14) in England has added a considerable number of new species from that country. Čejka ('12, pp. 11-17) described *H. parva* and *H. diverticulata* from New Siberia and Kotelnoi Islands off the coast of northern Siberia. Michaelsen ('13, pp. 211-213) added *H. columbiana* from Medellin, Colombia, S. A., and the writer ('14, pp. 126-140) described *H. moderata* and *H. urbanensis* from Illinois. Only two species of *Henlea* have been reported east of the Rocky Mountains in North America and the species to be described in this paper represents the first record of a *Henlea* from Michigan. During the summers of 1911-1913 the writer made some collections in the immediate vicinity of Douglas Lake, Michigan, and a new species of *Fridericia* has already been described (Welch, '14, pp. 154-158)) from this material. The major part of these collections has not been worked up but the writer hopes to present further data in the near future. The specimens on which this paper is based form a part of the above mentioned collections.

The new species to be described below has, in some respects, a close resemblance to the genus *Hepatogaster* described by Čejka

---

*Contribution from the University of Michigan Biological Station No. 23.

('10) but fails to conform to the definition of that genus in lacking the canals in the epithelium of the alimentary tract, in having the peptonephridia confined to VI, and in having the ental opening of the spermathecæ in V instead of VI. Since these discrepancies occur and since there is agreement with Michaelsen's definition of *Henlea* this species has been placed in the latter genus.

Definition.—Length, 15-19 mm. Diameter, about 0.64 mm. Somites, 65-66. Color, whitish yellow. *Prostomium blunt* and rounded. Head pore near 0/1. Dorsal pores absent. Setæ of about equal length, slightly bent proximally, 2-7 per bundle in the anterior and middle parts of the body, usually 6, number decreases in the posterior somites. Clitellum on XII-XIII. Lymphocytes nearly circular. Brain slightly more than twice as long as wide; anterior margin concave; posterior margin distinctly emarginate; lateral margins convergent cephalad. Peptonephridia present in VI; dorsal and ventral parts in close contact with digestive tract; dorsal peptonephridium with sparse branches which extend into cœlom. Esophagus passes abruptly into intestine in VIII. Intestinal diverticulum in VIII, entirely surrounding digestive tract. Dorsal vessel arises in IX. Each nephridium with small anteseptal part; postseptal part at least twice as large; efferent duct arises from ventral side of latter near septum. Spermiducal funnel with length about one and one-half times diameter. Spermathecæ, each with oval, slightly expanded ampulla near ectal end; diameter diminishing gradually toward ectal end; three or four pyriform, multicellular glands at ectal opening; spermathecæ uniting dorsad of digestive tract to form a cylindrical tube through which communication with digestive tract is affected.

The characters of the penial bulb are discussed on a later page.

Described from two sexually mature specimens. Type and paratype in the collection of the writer.

The specimens on which the above description is based were collected August 18, 1911, on the west shore of Burt Lake, Michigan. They were found in deciduous woods, under the decaying bark and in the associated dirt and debris of fallen timber. Both of the specimens are at the height of sexual maturity and agree perfectly in all structural details.

Affinities.—This species is closely related to *Henlea moderata* Welch. However, distinct differences in the brain, peptonephridia, clitellum, somites, setæ, and penial bulb occur. None of the other American species of the genus appear to be at all closely related. A comparison with foreign species is difficult and unsatisfactory since many of them are imperfectly described. As the descriptions stand at present this species appears to be distinct from foreign forms.

External Characters.

The body has an average length of about 17 mm., the extremes being 15 and 19. In transverse section it is circular in outline. The maximum diameter—approximately 0.6 mm.—is in the region of the clitellum and the diminution caudad is very slight. Anterior to the clitellum the diameter is about uniform. In the living specimens the body is whitish and opaque. The prostomium (Pl. IX, Fig. 5) is decidedly blunt and rounded. The intersegmental grooves are obscure, the first two or three being the only ones which are at all distinct. The number of somites varies from 65 to 66. The head pore is well-defined and located near the tip of the prostomium. The structure of this pore will be given in detail in another part of the paper. The clitellum is on XII-XIII and is prominent. The number of setæ per bundle varies from 2 to 7, the predominating numbers in the middle of the body being 5-7 and the smaller numbers occurring on the first two or three somites and in the posterior fourth of the worm. There seems to be no constant difference in the numbers of setæ in the bundles of the lateral and ventral rows. The setæ of a bundle are all of similar size and development and, in the specimens examined, extend but a short distance beyond the surface of the body. They are straight except for a slight bend at the proximal end and arranged in a fan-shaped cluster.

Internal Characters.

Body wall.—The cuticula is thin, delicate, and inconspicuous in sections except under high magnification. The hypodermis varies in thickness in different parts of the body. In the region of the prostomium it attains a maximum thickness of about 0.03 mm.

Anterior to the clitellum it has an average thickness of about 0.012 mm. and is slightly thicker on the lateral aspects than on the dorsal or ventral ones. Immediately posterior to the clitellum the hypodermis becomes very thin, never exceeding 0.01 mm. in thickness, and usually not more than 0.006 mm. The circular and longitudinal muscle layers of the body wall are both well-developed throughout the length of the body, the longitudinal layer being the thicker.

The clitellum is composed of closely set, columnar cells, all similar in shape, dimensions, and contents. The length of these cells, which represents the thickness of the clitellum, averages about 0.078 mm. and the transverse dimension about 0.012 mm. Spherical nuclei lie in the bases of the cells and the cytoplasmic contents take artificial stains with uniform intensity.

The head pore (Pl. IX, Fig. 5) is located near the tip of the prostomium and is larger than in other species of *Henlea* known to the writer. Sections show the lumen to be trumpet-shaped, widest at the ectal extremity, somewhat sigmoid in shape, and ovoid in transverse section. At the ectal extremity the transverse dimensions are as follows: sagittal dimension, 0.03 mm.; frontal dimension, 0.06 mm. Figures 8 and 9 show the structure of the body wall in the immediate vicinity of this pore.

Lymphocytes.—The lymphocytes (Pl. IX, Fig. 2) are both large and numerous. They are very sparsely distributed in the anterior end of the body but in V they begin to appear in large numbers and, in the specimens which were studied in this connection, the maximum is attained in the immediate vicinity of IX where lymphocytes are so numerous that they completely fill all of the available space in the body cavity and are so closely crowded together that many of them are distorted. They occur in all of the somites posterior to the clitellum but in much reduced numbers. The majority of the lymphocytes are almost circular in outline. A certain proportion approach the elliptical and crowding produces a number of other shapes. Measurements of a large number of lymphocytes showed the diameter to vary from 0.036 to 0.054 mm. Each has a conspicuous, central nucleus, the average diameter of which is about 0.006 mm. The cytoplasmic contents are somewhat reticular in appearance and have a decided affinity for artificial stains.

Brain.—The brain (Pl. IX, Fig. 7) lies entirely in I. The anterior margin is concave and the posterior margin is distinctly emarginate. The lateral margins converge cephalad and approach each other closest at a point just posterior to the origin of the commissural nerve trunks. The maximum width occurs near the caudal fourth of the organ and is about one and one-half times as wide as the minimum width. The ratio of the greatest length to the greatest width is 12:5, the actual measurements being about 0.24 mm. for the former and 0.10 mm. for the latter. In transverse section the organ is elliptical in outline, the ratio of the greatest width to the greatest thickness being about 10:7. The brain is attached to the body wall by a pair of supporting strands which arises from the lateral margins near the caudal extremities.

Peptonephridia.—Two peptonephridia are present, one on the dorsal and the other on the ventral side of the digestive tract in VI. Both adhere very closely to the walls of the latter and extend along it for approximately the length of VI. Each is an irregular, tubular mass showing ramifying lumina and nucleated walls. The dorsal peptonephridium gives off a few irregular branches which extend into the cœlom. No branches extend from the ventral peptonephridium.

Intestinal Diverticulum.—The intestinal diverticulum arises from the posterior end of the œsophagus in VIII. It is reflected cephalad, investing closely the digestive tract for the greater part of the length of the somite and occupying the major part of the body cavity. It is a single structure with two shallow, unequal, longitudinal depressions, one dorsal and the other ventral. It is about 0.40 mm. in length, about 0.35 mm. in sagittal diameter, and about 0.42 mm. in frontal diameter. Sections (Pl. IX, Fig. 10) show the organ to be made up of a series of branching, rather thick-walled tubules which arise from the digestive tract (Pl. IX, Fig. 11) in the posterior part of VIII, extending cephalad. At the origin of the diverticulum the number of tubules is rather small but a transverse section of the organ cephalad of its middle shows a large number of hollow tubules, indicating that these tubules branch. Sagittal sections also confirmed this observation. These tubules appear to end blindly in the cephalic end of the organ since careful study of sections under high magnification failed to show any evidence of anastomosis. Their walls contain numerous, distinct nuclei and are glandular in appearance. The tubules are all of the same structure although the cephalic extremities take artificial stains more intensely than do the parts nearer their origin. The region of the digestive tract from which these tubules arise is ciliated and cilia are also present in the bases of the main tubules. From the origin of the diverticulum from the digestive tract the perivisceral blood sinus is continued cephalad, constituting the spaces surrounding the tubules. The latter are so closely crowded together that the sinus spaces are reduced to a minimum. The peritoneal covering of the alimentary canal continues over the diverticulum as a complete investing membrane.

Structurally the intestinal diverticulum in this species resembles very closely that of *Henlea moderata* Welch, the difference being minute and rather unimportant. In an earlier paper, the writer ('14, pp. 138-139) compared the structure of the intestinal diverticulum of *H. moderata* with corresponding organs of other species of *Henlea* and it appeared that it possesses an unreported type of structure. The discovery of *H. tubulifera* adds a second species having a diverticulum of this type. However, it should be noted that a very similar type of structure is found in the intestinal diverticula of the genus *Hepatogaster.* The minute structure of this organ has not been described for many of the species of *Henlea* and as a consequence our knowledge of its various structural forms is very imperfect. Recent literature contains some further data on the character of this organ. Čejka ('12, p. 15) describes the structure of the intestinal diverticula in *H. diverticulata* as follows: "Durch das IX. und VIII. Segment verlaufen 4 grosse Darmtaschen, die am Ende des IX. Segment durch eine weite Öffnung mit dem Darmkanale im Zusammenhang stehen (. . .). Ihre Wände sind verschiedenartig gefaltet und vom Blutsinus reichlich umspült. Im Innern der Taschen treffen wir reichliche Cilien, wie im Darmkanale, was schon auf den gleichen Ursprung hindeutet. Allen Umständen nach müssen wir alle Darmtaschen der Henleinen als Darmausstülpungen ansehen; dagegen ist der Ursprung der Speicheldrüsen bisher unsicher." The same writer ('14, p. 17) describes the intestinal diverticula in *H. parva* as follows: "Im VIII./VII. Segment befinden sich 4 grosse Darmtaschen, die nach dem Darmepithel-Typus gebaut sind, aber nur spärlich Wimpern tragen (. . .). Ihre Wände zeigen fast gar keine Epithelfalten, was ich noch bei keiner *Henlea*-Art beobachtet habe, und was auf den ersten Blich auffallend ist. Durch das Dissepiment VIII./VII. sind diese Darmtaschen etwas eingeschnürt. Im VIII. Segment münden sie mit einer grossen Öffnung, deren Weite dem Lumen der Darmtaschen fast gleich kommt, in den Darmkanal." Michaelsen ('13, pp. 211-213), in discussing the anatomy of *Henlea colombiana,* describes certain problematical tubules in VII-IX, one on each side of the digestive tract, which were not definitely identified but which might possibly represent a form of intestinal diverticula.

Dorsal Blood-Vessel.—The dorsal blood-vessel arises from the perivisceral blood sinus in IX. For the greater part of its length it is small and inconspicuous. Swellings, about 0.04 mm. in diameter, occur in the immediate vicinity of the third pair of septal glands and also in IX, just before the vessel merges into the perivisceral sinus.

Nephridia.—The first nephridia are related to V/V. There is some variation in size and shape in the different regions of the body but, in general, the anteseptal part is at most not more than half the size of the postseptal part (Pl. IX, Fig. 1) and the efferent duct arises from the ventral part of the latter, near the septum.

Spermiducal Funnel.—The spermiducal funnel (Pl. IX, Fig. 6) is situated in the usual position in the posterior part of XI with its base in close proximity to the lower part of XI/XII. It is approximately one and one-half times as long as wide, the maximum dimensions being as follows: length 0.16 mm., diameter 0.10 mm. The collar is distinct but small, the diameter being only about 0.04 mm. The sperm duct is long, much contorted, and confined to XII.

Penial Bulb.—The penial bulb (Pl. IX, Fig. 3) is simple in its structure and conforms to the lumbricillid type. It is rather small as compared with the diameter of the body, somewhat elliptical in transverse section, and is covered with a moderate musculature. The interior of the bulb is filled with cells of but one kind. These cells vary somewhat in shape in the different parts of the bulb, but in general they are greatly elongated and are arranged radially about the penial lumen. The peripheral, nucleated parts of the cells stain more deeply than do the extensions which approach the penial lumen. At the ventral side of the bulb the cells merge gradually into the hypodermis of the body wall. The sperm duct meets the dorsal part of the bulb on the ectal side, penetrates it, and meets the penial lumen deep within the interior. There is sufficient differentation of parts at the junction of the sperm duct and the penial lumen to make the position of this union distinct.

When the penial bulb of *Henlea tubulifera* is compared with that of *Henlea moderata,* its nearest relative, it is found that the important difference is the absence of inner bulb cells in the former and the presence of such cells in the latter. In other structural respects the two bulbs are similar.

Ovaries.—The ovaries occur as usual in XII, in connection with the ventral part of XI/XII. They are massive and fill a considerable part of the cœlom. In the specimens examined in this connection the cœlomic cavity in XII is filled with developing ova.

Spermaries.—The spermaries are large and well-developed. In the specimens examined they are at the height of maturity and the available space in XI is filled with sperm cells in all stages of development.

Spermathecæ.—A single pair of spermathecæ lie in V. The ectal opening of each is lateral and slightly caudad of IV/V. Three or four well-defined, multicellular glands (Pl. IX, Fig. 4) occur in connection with the ectal terminus but no increased thickness of the hypodermis in the vicinity of the opening is apparent. There is no marked differentiation of duct and ampulla. Within the somewhat swollen ectal region the lumen attains its greatest diameter of 0.021 mm. This region is thick-walled, approximately 0.06 mm. in diameter, and includes about one-half of the entire spermatheca. The diameter decreases entad to 0.024 mm., the swollen region merging gradually into the duct-like portion which extends obliquely across the cœlom to a point dorsal of the digestive tract where it bends caudad. It meets and unites with the spermatheca of the opposite side in the posterior part of V, to form the large common duct which communicates with the digestive tract. This common duct has a maximum diameter of 0.06 mm. and a total length of 0.14 mm. It extends obliquely into the wall of the digestive tract and is actually included within it for some distance. The total length of a single spermatheca, exclusive of common duct, is about 0.30 mm.

Kansas State Agricultural College, May 9, 1914.

LITERATURE CITED.

Čejka, B.
- '10. Die Oligochæten der Russischen in den Jahren 1900-1903 unter- Enchytræiden (Hepatogaster). Mém. Acad. Sci. St. Pétersb. nommenen Nordpolarexpedition. I. Über eine neue Gattung der (8), 29, No. 2:1-29. 3 pl.
- '12. Die Oligochaeten der Russischen in den Jahren 1900-1903 unternommenen Nordpolarexpedition. II. Ueber neue Bryodrilus- und Henlea-Arten. Mém. Acad. Sci. St.-Pétersb. (8), 29, No. 6:1-19. 4 pl.

Friend, H.
- '12. British Enchytræids. IV. The Genus Henlea. Jour. R. Micr. Soc., pp. 577-598. 11 figs.
- '13a. British Enchytræids. V. Species new to Science. Jour. R. Micr. Soc., pp. 255-271. 13 figs.
- '13b. Annelid Hunting in Notts. Second Paper. 60th Report and Transactions of the Nottingham Naturalists' Soc. for 1911-1912, pp. 50-64.
- '13c. Some Jersey Oligochæts. Zoologist (4) 17:456-464.
- '14. Annelid Hunting in Notts. Third Paper. 61st Report and Transactions of the Nottingham Naturalists' Soc. for 1912-1913, pp. 20-38.

Michaelsen, W.
- '13. Die Oligochaeten Columbias. Voyage D'Exploration scientifique en Colombie. Volume V des Mémoires de la Sociéte neuchâteloise des Sciences naturelles, pp. 202-252. 1 pl.

Welch, P. S.
- '14. Studies on the Enchytræidæ of North America. Bull. Illinois State Lab. Nat. Hist., 10:123-212. 5 pl.

EXPLANATION OF PLATES.

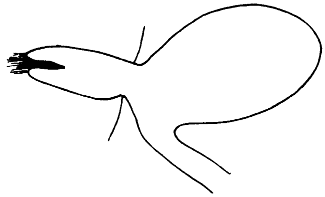
Abbreviations.

bl. s.,	blood sinus.
d. bl. v.,	dorsal blood vessel.
lum. dig. tr.,	lumen of digestive tract.
or. tu. div.,	origin of tubules of diverticulum.
pen. b. i.,	penial bulb invagination.
pen. lum.,	penial lumen.
pen. po.,	penial pore.
per. gl. c'l.,	peripheral gland cells.
r. m.,	retractor muscle.
sp. d.,	sperm duct.
tu. div.,	tubules of diverticulum.

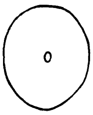
Figures.

Henlea tubulifera, n. sp.

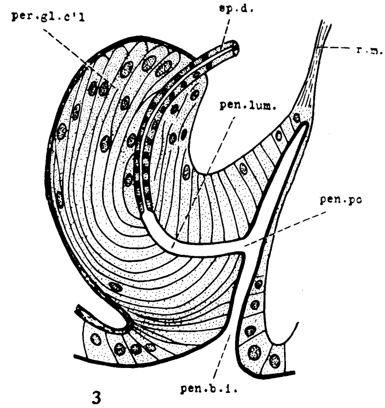
Fig. 1. Outline of typical nephridium.
Fig. 2. Lymphocyte.
Fig. 3. Penial bulb in transverse section of the worm.
Fig. 4. Spermatheca.
Fig. 5. Outline of anterior end of worm, lateral view.
Fig. 6. Spermiducal funnel.
Fig. 7. Outline of brain, dorsal view.
Fig. 8. Head pore as it appears in sagittal section of the worm.
Fig. 9. Head pore as it appears in transverse section of the worm. Drawing is made from section caudad of ectal opening.
Fig. 10. Transverse section of digestive tract in VIII, showing structure of intestinal diverticulum.
Fig. 11. Transverse section of digestive tract in posterior part of VIII, through origin of tubules of intestinal diverticulum.



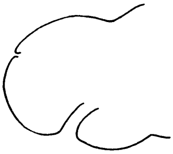
1



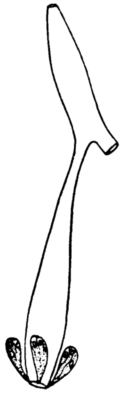
2



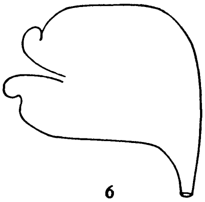
3



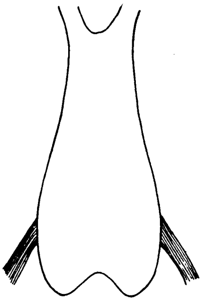
5



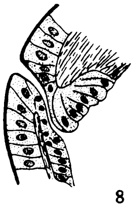
4



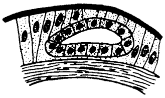
6



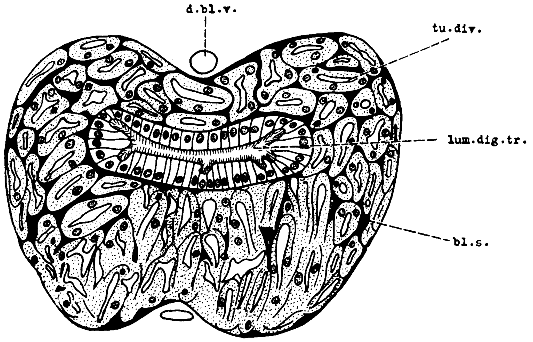
7



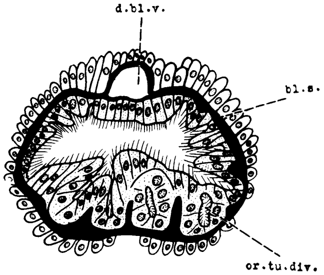
8



9



10



11

Henlea tubulifera n. sp.
(Pl. IX, Figs. 1-11)